

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

Claims 1-7 (cancelled).

8. (currently amended): A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and at least one client control apparatus is performed, the control system comprising:

 a first processing unit configured in the host control apparatus to embed emergency-stop data in a serial-data communication frame when a malfunction occurs inside the host control apparatus, or when an emergency-stop signal is inputted to the host control apparatus, to embed predetermined frame-error check data in the serial-data communication frame each time the serial-data communication frame is generated, and to output the frame to the client control apparatus;

 an extracting unit configured in the client control apparatus to extract the emergency-stop data and the frame-error check data from the frame that is transmitted from the host control apparatus to the client control apparatus; and

 a second processing unit configured in the client control apparatus to determine whether or not the frame has been generated normally in the host control apparatus by checking the frame-error check data extracted by the extracting unit, to output to an

apparatus to be controlled the emergency-stop data when the emergency-stop data is embedded in the serial-data communication frame, and the frame is generated normally in the host control apparatus, to block output of the emergency-stop data to the apparatus to be controlled when the emergency-stop data is embedded in the serial-data communication frame, and the frame[[sJ]] is not generated normally in the host control apparatus, and to output to the apparatus to be controlled the emergency-stop data when condition in which the frame is not generated normally in the host control apparatus is continued for a duration corresponding to a plurality of frames.

9. (previously presented): A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and at least one client control apparatus is performed, the control system comprising:

 a first processing unit configured in the client control apparatus to embed emergency-stop data in a serial-data communication frame to be outputted by the client control apparatus when a malfunction occurs inside the client control apparatus, to embed predetermined frame-error check data in the serial-data communication frame to be outputted by the client control apparatus each time the serial-data communication frame is generated , and to output the frame to the host control apparatus;

 an extracting unit configured in the host control apparatus to extract the emergency-stop data and the frame-error check data from the frame that is transmitted from the client control apparatus to the host control apparatus; and

 a second processing unit configured in the host control apparatus to determine whether or not the frame has been generated normally in the client control apparatus by

checking the frame-error check data extracted by the extracting unit, to determine that the client control apparatus is in order when the emergency-stop data is embedded in the serial-data communication frame and the frame is generated normally in the client control apparatus, and to determine that the client control apparatus is out of order when the emergency-stop data is embedded in the serial-data communication and condition in which the frame is not generated normally in the client control apparatus is continued for a duration corresponding to a plurality of frames.

10. (previously presented): A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and a plurality of client control apparatuses, or among the plurality of client control apparatuses, is performed, the control system comprising:

 a first processing unit configured in the client control apparatus to embed emergency-stop data in a serial-data communication frame to be outputted by the client control apparatus when a malfunction occurs inside of the client control apparatus, or when an emergency-stop signal is inputted to the client control apparatus, to embed predetermined frame-error check data in the serial-data communication frame to be outputted by the client control apparatus each time the serial-data communication frame is generated, and to output the frame to the host control apparatus and/or the other client control apparatus;

 an extracting unit configured in the client control apparatus to extract the emergency-stop data and the frame-error check data from the frame that is transmitted from the host control apparatus and /or the other client control apparatus; and

a second processing unit configured in the client control apparatus to determine whether or not the frame has been generated normally in the host control apparatus and/or the other client control apparatus by checking the frame-error check data extracted by the extracting unit, to output to an apparatus to be controlled the emergency-stop data when the emergency-stop data is embedded in the serial-data communication frame and the frame is generated normally in the host control apparatus and/or the other client control apparatus, to block output of the emergency-stop data to the apparatus to be controlled when the emergency-stop data is embedded in the serial-data communication frame and the frame is not generated normally in the host control apparatus and/or the other client control apparatus, and to output to the apparatus to be controlled the emergency-stop data when condition in which the frame is not generated normally in the host control apparatus and/or the other client control apparatus is continued for a duration corresponding to a plurality of frames.

11. (previously presented): The control system utilizing serial-data communication, according to any one of claim 8 through 10, wherein the first processing unit generates the frame-error check data to which a specific numerical value is added when the frame is generated normally each time the serial-data communication frame is generated, and embeds the generated frame-error check data in the frame; and wherein the second processing unit compares previously received frame-error check data with presently received frame-error check data and determines that the frame is not generated normally when a difference value between the previously received frame-error check data and the presently received frame-error check data is different from the specific numerical value.

12. (previously presented): The control system utilizing serial-data communication according to any one of claim 8 through 10, in which the serial-data communication between the host control apparatus and the plurality of client control apparatuses, or among the plurality of client control apparatuses, is performed, the control system comprising:

a third processing unit configured in the client control apparatus to embed the emergency-stop data generated by the other client control apparatus in the frame to be outputted by the client control apparatus, and to transmit the frame to the host control apparatus and/or the other client control apparatus.

13. (previously presented): The control system utilizing serial-data communication according to any one of claims 8 through 10, comprising:

a counting unit configured in the host control apparatus and/or the client control apparatus to count the number of the received frames; and

a third processing unit configured in the host control apparatus and/or the client control apparatus to output the emergency-stop signal in the case where a specific number of frames are not received.

14. (new): The control system utilizing serial-data communication according to claim 8, further comprising:

a voltage level converter to convert a voltage level of the emergency-stop data to a voltage level utilized within the host control apparatus;

a communication control unit to convert the emergency-stop data into serial data;

and

a communication connector to transmit the converted emergency-stop data.

15. (new): The control system utilizing serial-data communication according to claim 9,
further comprising:

a voltage level converter to convert a voltage level of the emergency-stop data to
a voltage level utilized within the host control apparatus;

a communication control unit to convert the emergency-stop data into serial data;

and

a communication connector to transmit the converted emergency-stop data.

16. (new): The control system utilizing serial-data communication according to claim 10,
further comprising:

a voltage level converter to convert a voltage level of the emergency-stop data to
a voltage level utilized within the host control apparatus;

a communication control unit to convert the emergency-stop data into serial data;

and

a communication connector to transmit the converted emergency-stop data.

17. (new): The control system utilizing serial-data communication according to claim 8,
wherein data that is transmitted and received between the host control apparatus and the client
control apparatus comprises:

a start-flag generating unit for, on reception, generating a start flag required to start reception sequence;

a transmission-data generating unit for generating transmission data in which a positional instruction, speed instruction, and other data for communication are put together;

an emergency-stop data generating unit for generating an emergency-stop data that has been inputted through a receiver to the host control apparatus;

a frame-error check counter generating unit for adding a present value to a frame-error check counter area in a transmission frame at predetermined time intervals; and

an end-flag generating unit for generating an end flag that indicates an end of data transmission.

18. (new): The control system utilizing serial-data communication according to claim 9, wherein data that is transmitted and received between the host control apparatus and the client control apparatus comprises:

a start-flag generating unit for, on reception, generating a start flag required to start reception sequence;

a transmission-data generating unit for generating transmission data in which a positional instruction, speed instruction, and other data for communication are put together;

an emergency-stop data generating unit for generating an emergency-stop data that has been inputted through a receiver to the host control apparatus;

a frame-error check counter generating unit for adding a present value to a frame-error check counter area in a transmission frame at predetermined time intervals; and
an end-flag generating unit for generating an end flag that indicates an end of data transmission.

19. (new): The control system utilizing serial-data communication according to claim 10, wherein data that is transmitted and received between the host control apparatus and the client control apparatus comprises:

a start-flag generating unit for, on reception, generating a start flag required to start reception sequence;
a transmission-data generating unit for generating transmission data in which a positional instruction, speed instruction, and other data for communication are put together;
an emergency-stop data generating unit for generating an emergency-stop data that has been inputted through a receiver to the host control apparatus;
a frame-error check counter generating unit for adding a present value to a frame-error check counter area in a transmission frame at predetermined time intervals; and
an end-flag generating unit for generating an end flag that indicates an end of data transmission.

20. (new): The control system utilizing serial-data communication according to claim 8, further comprising:

an emergency-stop data adding unit for holding received emergency-stop data in order to copy the emergency-stop data for transmission to an emergency-stop data generating unit.

21. (new): The control system utilizing serial-data communication according to claim 9, further comprising:

an emergency-stop data adding unit for holding received emergency-stop data in order to copy the emergency-stop data for transmission to an emergency-stop data generating unit.

22. (new): The control system utilizing serial-data communication according to claim 10, further comprising:

an emergency-stop data adding unit for holding received emergency-stop data in order to copy the emergency-stop data for transmission to an emergency-stop data generating unit.

23. (new): The control system utilizing serial-data communication according to claim 8, wherein the emergency-stop data is received from an emergency stop switch in a non-serial format by the host control apparatus and wherein voltage level of the received emergency-stop data is higher than voltage level utilized in the host apparatus.

24. (new): The control system utilizing serial-data communication according to claim 9, wherein the emergency-stop data is received from an emergency stop switch in a non-serial

format by the host control apparatus and wherein voltage level of the received emergency-stop data is higher than voltage level utilized in the host apparatus.

25. (new): The control system utilizing serial-data communication according to claim 10, wherein the emergency-stop data is received from an emergency stop switch in a non-serial format by the host control apparatus and wherein voltage level of the received emergency-stop data is higher than voltage level utilized in the host apparatus.